

What is claimed is:

1. A fuel injection device comprising:

a valve body that includes:

a downstream end opening;

a fuel passage communicated with the downstream end opening; and

a valve seat located adjacent to the downstream end opening;

a valve member that is located radially inward of the valve body and is seatable against the valve seat of the valve body;

an injection hole plate that includes a cover wall, which covers the downstream end opening of the valve body, wherein the cover wall includes at least one injection hole formed through the cover wall; and

a nozzle holder that receives the valve body, wherein:

the nozzle holder includes a support portion, which supports a downstream end surface of the cover wall of the injection hole plate; and

the injection hole plate is welded to one of the valve body and the nozzle holder.

2. The fuel injection device according to claim 1, wherein the injection hole plate is clamped between the valve body and the support portion of the nozzle holder.

3. The fuel injection device according to claim 1, wherein the

injection hole plate is clamped between the valve body and the nozzle holder.

4. The fuel injection device according to claim 1, wherein the cover wall of the injection hole plate is curved and is thus convex in an upstream direction toward the downstream end opening such that the cover wall is urged against a peripheral edge of the downstream end opening of the valve body.

5. The fuel injection device according to claim 1, wherein the injection hole plate is welded to the nozzle holder from outside of the nozzle holder.

6. The fuel injection device according to claim 1, wherein:  
the injection hole plate further includes a peripheral wall, which extends from the cover wall in an upstream direction; and  
the peripheral wall is fitted to one of the valve body and the nozzle holder.

7. The fuel injection device according to claim 6, wherein the peripheral wall of the injection hole plate is welded to the one of the valve body and the nozzle holder along an entire perimeter of the peripheral wall.

8. The fuel injection device according to claim 6, wherein the cover wall of the injection hole plate is welded to the one of the valve body and the nozzle holder at a welding portion, which

is located radially outward of the injection hole.

9. The fuel injection device according to claim 1, wherein a downstream end surface of the valve member is generally flat.

10. The fuel injection device according claim 1, wherein a downstream end of the valve member and the injection hole plate define a generally flat fuel space therebetween.

11. The fuel injection device according to claim 1, wherein the fuel injection device is of a direct injection type that directly injects fuel into a combustion chamber of an internal combustion engine.

12. A fuel injection device comprising:

- a valve body that includes:

- a downstream end opening;

- a fuel passage communicated with the downstream end opening; and

- a valve seat located adjacent to the downstream end opening;

- a valve member that is located radially inward of the valve body and is seatable against the valve seat of the valve body;

- an injection hole plate that includes a cover wall, which covers the downstream end opening of the valve body, wherein the cover wall includes at least one injection hole formed through the cover wall; and

a nozzle holder that receives the valve body, wherein:

the nozzle holder includes a support portion, which supports a downstream end surface of the cover wall of the injection hole plate; and

the cover wall of the injection hole plate is curved and is thus convex in an upstream direction toward the downstream end opening such that the cover wall is urged against a peripheral edge of the downstream end opening of the valve body.

13. A fuel injection device comprising:

a valve body that includes:

a downstream end opening;

a fuel passage communicated with the downstream end opening; and

a valve seat located adjacent to the downstream end opening;

a valve member that is located radially inward of the valve body and is seatable against the valve seat of the valve body;

an injection hole plate that includes a cover wall, which covers the downstream end opening of the valve body, wherein the cover wall includes at least one injection hole formed through the cover wall; and

a nozzle holder that receives the valve body, wherein:

the nozzle holder includes a support portion, which supports a downstream end surface of the cover wall of the injection hole plate;

the cover wall of the injection hole plate includes a thin

wall portion and a thick wall portion, wherein the thin wall portion covers the downstream end opening of the valve body, and the thick wall portion is formed around the thin wall portion; and

the at least one injection hole is formed through the thin wall portion of the cover wall.

14. A fuel injection device according to claim 13, wherein the injection hole plate is clamped between the valve body and the nozzle holder.

15. A fuel injection device according to claim 13, wherein:  
the injection hole plate further includes a peripheral wall, which extends from the cover wall in an upstream direction; and  
the peripheral wall is fitted to one of the valve body and the nozzle holder.

16. A fuel injection device according to claim 13, wherein the cover wall of the injection hole plate is curved and is thus convex in an upstream direction toward the downstream end opening such that the cover wall is urged against a peripheral edge of the downstream end opening of the valve body.

17. A fuel injection device according to claim 15, wherein the peripheral wall of the injection hole plate is welded to one of the valve body and the nozzle holder along an entire perimeter of the peripheral wall.

18. A fuel injection device according to claim 15, wherein the cover wall of the injection hole plate is welded to one of the valve body and the nozzle holder at a welding portion, which is located radially outward of the injection hole.

19. A fuel injection device according to claim 13, wherein a wall thickness of the thin wall portion of the cover wall is equal to or greater than a value obtained by multiplying a wall thickness of the thick wall portion of the cover wall by 0.4.

20. A fuel injection device according to claim 13, wherein a wall thickness of the thin wall portion of the cover wall is equal to or less than a value obtained by multiplying an inner diameter of the injection hole by 2.

21. A fuel injection device according to claim 13, wherein the injection hole plate is welded to the nozzle holder from outside of the nozzle holder.

22. A fuel injection device according to claim 13, wherein a downstream end surface of the valve member is generally flat.

23. A fuel injection device according to claim 13, wherein a downstream end of the valve member and the injection hole plate define a generally flat fuel space therebetween.

24. A fuel injection device according to claim 13, wherein the fuel injection device is of a direct injection type that directly injects fuel into a combustion chamber of an internal combustion engine.

25. A fuel injection device comprising:

- a valve body that includes:

  - a downstream end opening;

  - a fuel passage communicated with the downstream end opening; and

  - a valve seat located adjacent to the downstream end opening;

  - a valve member that is located radially inward of the valve body and is seatable against the valve seat of the valve body; and

  - an injection hole plate that includes a cover wall, which covers the downstream end opening of the valve body, wherein the cover wall includes at least one injection hole formed through the cover wall, wherein:

    - the cover wall includes a reinforcing rib located radially outward of the injection hole; and

    - a portion of the cover wall, which has a projecting length smaller than that of the reinforcing rib, is welded to the valve body.

26. The fuel injection device according to claim 25, wherein:

- the injection hole plate further includes a peripheral wall,

which extends from the cover wall in an upstream direction; and  
a downstream end of the valve body is located radially inward of the peripheral wall of the injection hole plate.

27. The fuel injection device according to claim 25, wherein the portion of the cover wall, which is welded to the valve body, is located radially outward of a radially innermost peripheral edge of the reinforcing rib.

28. The fuel injection device according to claim 25, wherein the portion of the cover wall, which is welded to the valve body, is located radially outward of the injection hole and extends continuously in a circumferential direction.

29. The fuel injection device according to claim 25, wherein the reinforcing rib extends continuously in a circumferential direction of the cover wall.

30. The fuel injection device according to claim 25, wherein the reinforcing rib protrudes in a downstream direction from a downstream end surface of the cover wall.

31. The fuel injection device according to claim 30, wherein the portion of the cover wall, which is welded to the valve body, is a base portion of the reinforcing rib.

32. The fuel injection device according to claim 31, wherein



the cover wall is laser welded to the valve body by a laser beam irradiated onto the base portion from a point located radially outward of the reinforcing rib.

33. The fuel injection device according to claim 25, wherein:

an outer section of the cover wall located radially outward of the injection hole forms a thick wall portion that has a wall thickness greater than that of an inner section of the cover wall, which is located radially inward of the outer section of the cover wall and has the injection hole;

the thick wall portion includes a recessed groove, wherein the reinforcing rib is arranged radially inward of the recessed groove; and

the portion of the cover wall, which is welded to the valve body, is a bottom part of the recessed groove.